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FOLDING KEYBOARD WITH AUTOMATIC STATE INITIATOR

BACKGROUND

1. Field of the Present Invention

The present invention generally relates to the field of computer keyboards and more particularly to a folding keyboard with an automatic state initiator.

2. History of Related Art

Computer systems including personal digital assistants, notebook computers, laptop computers, personal computers, server systems, and enterprise systems are universally prevalent in a vast assortment of business, scientific, commercial, and home applications. Each of these computer systems utilizes a form of input device for receiving data from the user; with keyboards being the most prevalent form for such devices.

Keyboards typically have an elongated rectangular form with alphanumeric keys and special control keys appropriate to the data processing system arranged horizontally in parallel rows and staggered columns on the face of the keyboard. In addition to the special control keys, other keyboards include integrated mouse pads for controlling the movement of the cursor and for selecting various icons in operating systems utilizing graphical user interfaces.

In an effort to reduce the space occupied by the monitor and keyboard (i.e., footprint), monitor and data processing system manufacturers have taken to designing desktop monitors and data processing systems with space underneath them in order for the user to move the keyboard underneath when not in use. It would be beneficial if monitor and data processing system design could be independent of addressing keyboard storage issues or if the space required for accommodating keyboards could be minimized. Further, while data

processing systems are configured to enter a power saving "sleep" mode after a pre-determined time period has elapsed in which no activity on the keyboard or mouse pad is detected, it remains difficult, if not cumbersome for a user to selectively direct a data processing system to enter a power saving sleep mode.

Accordingly, it is highly desirable to provide for a keyboard that, when not in use, occupies a smaller footprint and that can direct the data processing system to enter into a sleep mode or a wake mode in response to the use state of the keyboard.

SUMMARY OF THE INVENTION

The problems identified above are in large part addressed by a keyboard for a data processing system designed to selectively assume an extended position or a space-saving, collapsed position and further designed to generate a state signal for directing the data processing system to transition between a wake mode and a sleep mode in response to a change in the extension state of the keyboard.

Briefly and in general terms, a folding keyboard for a data processing system according to one embodiment of the invention includes two or more keyboard sections, keys attached to the keyboard sections, and a keyboard housing for receiving the keyboard sections. The keyboard is typically configured to assume a first position in which the keyboard sections are extended, and is further configured to assume a second position in which the keyboard sections are collapsed. In one embodiment, the keyboard would include one or more connectors attached to the keyboard sections for transitioning the keyboard from the extended position to the collapsed position. The keyboard may further include rollers for facilitating movement of the keyboard between the extended position and the collapsed position.

In another embodiment, the keyboard includes a locking mechanism for selectively maintaining the keyboard in the extended position or the collapsed position. The keyboard is preferably configured to transmit in response to a change in the extension state of the keyboard, a state signal to the data processing system for directing the data processing system to transition between a wake mode and a sleep mode. In one embodiment, the keyboard would include a state switch for generating the state signal to the data processing system.

Other aspects and advantages of the present invention will become apparent from the following detailed description when taken in conjunction with the accompanying drawings, illustrating by way of example the principles of the present invention.

BRIEF DESCRIPTION OF THE DRAWINGS

Other objects and advantages of the invention will become apparent upon reading the following detailed description and upon reference to the accompanying drawings in which:

FIG. 1 is a top plan view of a keyboard according to one embodiment of the present invention;

FIG. 2 is a side plan view of a keyboard according to one embodiment of the present invention depicting the keyboard in a position between an extended position and a collapsed position;

FIG. 3 is a side plan view of a keyboard according to one embodiment of the present invention depicting the keyboard in a collapsed position;

FIG. 4 is a side plan view of a keyboard according to one embodiment of the present invention depicting the keyboard in an extended position; and

FIG. 5 depicts a data processing system including the keyboard of FIG. 1.

While the invention is susceptible to various modifications and alternative forms, specific embodiments thereof are shown by way of example in the drawings and will herein be described in detail. It should be understood, however, that the drawings and detailed description presented herein are not intended to limit the invention to the particular embodiment disclosed. On the contrary, the invention is limited only by the claim language.

DETAILED DESCRIPTION OF THE INVENTION

As shown in the drawings for purposes of illustration, the present invention contemplates a keyboard for a data processing system, the keyboard being designed to assume an extended position or a space-saving, collapsed position. For purposes of clarity, the position of the keyboard (i.e., extended position, collapsed position, or a position between the two) is hereinafter referred to as the "extension state of the keyboard." The keyboard is further designed to generate a state signal for directing the data processing system to transition between a wake mode and a sleep mode in response to a change in the extension state of the keyboard. Throughout the description and the drawings, elements which are the same will be accorded the same reference numerals.

Turning now to the drawings, FIG. 1 and FIG. 2 depict a top plan view and a side plan view, respectively, of a keyboard **100** according to one embodiment of the invention. In the depicted embodiment, keyboard **100** includes a keyboard housing **150** and a set of

keyboard sections **160**, **170**, **180**, and **190**, respectively. Keys **195** are connected to one or more of the keyboard sections. In the depicted embodiment, keys **195** are connected to keyboard sections **160**, **170**, and **180** and a palm rest having mouse pad **199** is included in keyboard section **190**.

Keyboard housing **150** may be suitably sized and shaped for receiving one or more of keyboard sections **160**, **170**, **180**, and **190**. In the depicted embodiment, keyboard housing **150** includes a mounting plate **151**, a back plate **152**, a top plate **153**, a front plate **154**, and a slider **210** operatively coupled to mounting plate **151**. Front plate **154** is movably attached to top plate **153** by way of a suitable connector so as to selectively permit front plate **154** to be moved to (and in an alternative embodiment, remain in) an open position in order to allow keyboard housing **150** to receive keyboard sections **160**, **170**, **180**, and **190** when keyboard **100** is in the collapsed position. In the depicted embodiment, the connector is implemented with a hinge **250**.

Keyboard housing **150** is movably attached to the set of keyboard sections by way of a suitable connector so as to permit keyboard housing **150** to receive the set of keyboard sections. In the depicted embodiment, the connector is implemented by a hinge **110** and slider **210**. Hinge **110** connects a trailing edge **265** of keyboard section **160** to slider **210**. Slider **210** is operatively coupled to mounting plate **151** so as to permit trailing edge **265** of keyboard section **160** to travel between a front edge **260** and a back edge **255** of mounting plate **151**.

While mounting plate **151** is shown in the depicted embodiment to be the bottom of keyboard housing **150**, it is to be understood that any plate of keyboard housing **150** including side plates (which are not depicted) may be utilized as the mounting plate for connecting slider **210**. Further, it is to be understood that one or more slider(s) **210** may be implemented along the trailing edge **265** of keyboard section **160** to facilitate the movement of trailing edge **265** between the front edge **260** and a back edge **255** of mounting plate **151**.

Keyboard sections are movably attached to one another by way of suitable connectors so as to permit keyboard **100** to assume a first position in which each of the keyboard sections **160**, **170**, **180**, and **190** are extended from keyboard housing **150** (as depicted and described in more detail in FIG. 4 below) and to assume a second position in which each of the keyboard sections are collapsed and contained within keyboard housing **150** (as depicted and described in more detail in FIG. 3 below). As depicted in the present embodiment, leading edge **270** of keyboard section **160** is movably attached to trailing edge **275** of keyboard section **170**, leading edge **280** of keyboard section **170** is movably attached to trailing edge **285** of keyboard section **180**, and leading edge **290** of keyboard section **180** is

movably attached to trailing edge **285** of keyboard section **190** by way of suitable connectors. In the depicted embodiment, the connectors are implemented with a hinge **120**, a hinge **130**, and a hinge **140**, respectively. Each of hinge **110**, hinge **120**, hinge **130**, and hinge **140** may (as depicted) run the length of front edge **260** of keyboard housing **150** and the length of the trailing edges and the leading edges of the keyboard sections **160, 170, 180**, and **190**, respectively. Typically, keys **195** are (as depicted) arranged in parallel, horizontal rows on keyboard sections **160**, **170**, and **180** in order to facilitate placement and operations of hinges **120**, **130**, and **140** so as to permit adjacent keyboard sections to be folded horizontally along a line between adjacent rows of the keys.

In alternative embodiments (not depicted), hinges **110**, **120**, **130**, and **140**, respectively, may include a series of hinges mounted along the adjacent edges of keyboard housing **150** and keyboard sections **160**, **170**, **180**, and **190**, respectively, the side edges of keyboard housing **150** and keyboard sections **160**, **170**, **180**, and **190**, respectively, or a combination of the foregoing. Hinges **110**, **120**, **130**, and **140** may be of any suitable type of hinge structure appropriate for the expected usage such as a single piano hinge, suitable protruding members and notches for receiving such members molded into the applicable edges of keyboard sections, and other hinges known to persons skilled in the applicable arts. Further, hinges **110**, **120**, **130**, and **140**, respectively, may preferably incorporate electrical signal connectors suitable for transmitting signals generated when any of the keys or the mouse pad of keyboard sections **160**, **170**, **180**, and **190** are depressed or is utilized, respectively.

Keyboard **100** is further preferably configured to transmit a state signal to the data processing system directing the data processing system to transition between a wake mode and a sleep mode in response to a change in the extension state of keyboard **100**. In the depicted embodiment, switch **240** senses a change in the extension state of keyboard **100** upon movement of hinge **120** and transmits the appropriate state signal. It is to be understood that while switch **240** is depicted as connected to hinge **100**, switch **240** may be connected to any of hinges **110**, **120**, **130**, and **140**. In an alternative embodiment (not shown), switch **240** may be coupled to slider **210** and wherein responsive to the direction of movement of slider **210**, the state signal contains information for directing the data processing system to transition between a wake mode and a sleep mode. Typically, the state signal contains information for directing the data processing system to transition to a wake mode upon keyboard **100** entering an extended state and to transition to a sleep mode upon keyboard **100** entering a collapsed state.

To facilitate movement of keyboard **100** between an extended state and a collapsed state, keyboard **100** may also include rolling devices. As depicted in the present embodiment, keyboard **100** includes roller **220** attached to leading edge **280** of keyboard section **170** and trailing edge **285** of keyboard section **180** and roller **230** attached to leading edge **299** of keyboard section **190**. It is to be understood that rollers **220** and **230** may run the length of the trailing edges and the leading edges of the keyboard sections **170**, **180**, and **190**, respectively, or alternatively, may include a series of rollers mounted along the adjacent edges of keyboard sections **170** and **180** and the leading edge of keyboard section **190**, respectively, the side edges of keyboard **170**, **180**, and **190**, respectively, or a combination of the foregoing.

Turning to FIG. 3, keyboard **100** is depicted in a collapsed state. In the collapsed state (as depicted), slider **210** has traveled to back edge **255** of keyboard housing **150**, hinges **110**, **120**, **130**, and **140** have operatively rotated so as to permit keyboard sections **160**, **170**, **180**, and **190** to be contained within keyboard housing **150**. In one embodiment, any keys or mouse pad contained on the keyboard section closest to the front edge **260** of keyboard housing **150** remain accessible when keyboard **100** is in a collapsed state. Typically, when transitioning to the collapsed state, switch **240** transmits a state signal for directing the data processing system to transition to a sleep mode.

Turning to FIG. 4, keyboard **100** is depicted in an extended state. In the extended state (as depicted), slider **210** has traveled to front edge **260** of keyboard housing **150**, hinges **110**, **120**, **130**, and **140** have operatively rotated so as to permit keyboard sections **160**, **170**, **180**, and **190** to be extended preferably so as to permit the keyboard to lie flat on a surface. Typically, when transitioning to the extended state, switch **240** would have transmitted a state signal for directing the data processing system to transition to a wake mode. Keyboard **100** may include lock **410** which is operatively coupled to mounting plate **151** and configured to selectively maintain keyboard **100** in an extended state or a collapsed state. In one embodiment, lock **410** may restrict movement of slider **210** so as to cause keyboard **100** to remain in an extended state. In an alternative embodiment, lock **410** may be operatively coupled to mounting plate **151** and configured to restrict movement of leading edge **299** of keyboard section **190** when leading edge **299** is inside keyboard housing **150** so as to cause keyboard **100** to remain in a collapsed state.

In yet alternative embodiments, lock **410** may include a series of locks mounted along the adjacent edges of keyboard housing **150** and keyboard sections **160**, **170**, **180**, and **190**, respectively, the side edges of keyboard housing **150** and keyboard sections **160**, **170**, **180**,

and **190**, respectively, or a combination of the foregoing. Lock **410** may be of any type of suitable lock structure appropriate for the expected usage such as a pin which may extend through mounting plate **151** and which may be selectively engaged to restrict movement of slider **210**; one or more pins or latches attached to keyboard housing **150** and keyboard sections **160**, **170**, **180**, and **190**, respectively, and which may be selectively engaged to couple keyboard housing **150** and keyboard sections **160**, **170**, **180**, and **190**, respectively; and other locks known to persons skilled in the applicable arts.

Turning to FIG. 5, selected features of a data processing system **500** according to one embodiment of the present invention are shown. In the depicted embodiment, data processing system **500** includes one or more processors P1 **505** through Pn **510** that are connected and have access to a system memory **515** via a system bus **530**. Processors P1 **505** through Pn **510** may be implemented with any of a variety of general purpose microprocessors including, as examples, the "PowerPC" family of processors from IBM Corporation and x86 type processors such as the "Pentium" family of processors from Intel Corporation. System memory **515** is typically implemented with volatile storage elements such as an array of dynamic RAM (DRAM) components.

A bus bridge **540** provides an interface between system bus **530** and a peripheral bus **545**. Peripheral bus **545** is typically implemented according to an industry standard peripheral bus protocol or specification such as the Peripheral Components Interface (PCI) protocol as specified in *PCI Local Bus Specification Rev 2.2*, from the PCI Special Interest Group (www.pcisig.org). Data processing system **500** may include one or more peripheral devices **550** and **555** connected to peripheral bus **545**. These peripheral devices could include as examples, a hard disk controller, a high speed network interface card, a graphics adapter, and so forth as will be familiar to those skilled in the design of microprocessor-based data processing systems.

Data processing system **500** further includes a keyboard controller **520** connected to peripheral bus **545** and a keyboard **100** (according to the present invention) connected to keyboard controller **520** via a keyboard "bus" **535**. Keyboard controller **520** is configured to receive keyboard signals from keyboard **100** via keyboard bus **535** and communicate those signals to processor(s) P1 **505** through Pn **510** via peripheral bus **545**. These keyboard signals may include a "wake" signal that is generated when keyboard **100** is extended from a collapsed position and a "sleep" signal that is generated when keyboard **100** is collapsed from an extended position. In an alternative embodiment, keyboard controller **520** may be connected to system bus **530** and may be configured to receive keyboard signals from keyboard **100** via keyboard bus **535** and communicate those signals to processor(s) P1 **505**

through Pn **510** via system bus **530**.

Keyboard bus **535** may include a conventional PS/2 bus as is known in the art, a Universal Serial Bus, or both. Keyboard controller **520** may be implemented with or comprise a portion of a commercially distributed component such as the SuperIO chip from National Semiconductor (www.national.com). In an embodiment where either the "wake" signal, the "sleep" signal, or both are not recognized by the operating system, keyboard controller **520** may further include dedicated hardware and a driver installed in system memory **515** that permit the data processing system **500** to interpret the wake and sleep signals from keyboard **100** and instruct processors P1 **505** through Pn **510** to transition to appropriate wake or sleep modes in response to those signals.

A person skilled in the art will appreciate that as used herein, the terms "sleep" mode and "wake" mode refer to power managed state transitions entered into by a data processing system in an effort to appropriately manage power consumption requirements. So as to lower power consumption requirements, the data processing system may enter one or more levels of a "sleep" mode. Such "sleep" modes may include a "suspend" state which, when activated, may slow down the CPU clock(s), spin down applicable drive units, save the state of various applications then running, and suspend or stop other peripheral functions. "Wake" mode typically involves increasing the power consumption requirements and if applicable, "re-awakening" the data processing system to assume a typical operating state in which the CPU clocks, applicable drive units, applications, and other peripheral functions are activated.

It will be apparent to those skilled in the art having the benefit of this disclosure that the present invention contemplates a keyboard for a data processing system, the keyboard being designed to selectively assume an extended position or a space-saving, collapsed position within a keyboard housing. The keyboard is further designed to generate a state signal for directing the data processing system to transition between a wake mode and a sleep mode in response to a change in the extension state of the keyboard. It is understood that the forms of the invention shown and described in the detailed description and the drawings are to be taken merely as presently preferred examples and that the invention is limited only by the language of the claims.